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ESD-TR-85-114

MTR-9338

AIR FORCE GEOPHYSICS LABORATORY
MANAGEMENT INFORMATION SYSTEM STUDY

By

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NOVEMBER 1985

Prepared for

INFORMATION SYSTEMS MANAGEMENT DIVISION
AIR FORCE GEOPHYSICS LABORATORY
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE

Hanscom Air Force Base, Massachusetts

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Project No. 479B

Prepared by

THE MITRE CORPORATION
Bedford, Massachusetts

Contract No. F19628-84-C-0001

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REVIEW AND APPROVAL

This technical report has been reviewed and is approved for publication.

FOR THE COMMANDER

EUNICE C. CRONIN, Director, GM-15
Information Systems Management Division

SECURITY CLASSIFICATION OF THIS PAGE

AD-A161910

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	Approved for public release; distribution unlimited.

4. PERFORMING ORGANIZATION REPORT NUMBER(S) MTR-9338 ESD-TR-85-114	5. MONITORING ORGANIZATION REPORT NUMBER(S)

6a. NAME OF PERFORMING ORGANIZATION The MITRE Corporation	6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION

6c. ADDRESS (City, State and ZIP Code) Burlington Road Bedford, MA 01730	7b. ADDRESS (City, State and ZIP Code)

8a. NAME OF FUNDING/SPONSORING ORGANIZATION Information Systems Management Division	8b. OFFICE SYMBOL (If applicable) AFGL/SI	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F19628-84-C-0001

8c. ADDRESS (City, State and ZIP Code) Air Force Geophysics Laboratory Hanscom AFB, MA 01731-5000	10. SOURCE OF FUNDING NOS.			
	PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT NO.

11. TITLE (Include Security Classification) Air Force Geophysics
Laboratory Management Information System Study

PROJECT NO. 479B

12. PERSONAL AUTHOR(S)
Alice A. Hayen

13a. TYPE OF REPORT Final	13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (Yr., Mo., Day) 1985 November	15. PAGE COUNT 46

16. SUPPLEMENTARY NOTATION

17.	COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB. GR.	Management Information System (MIS) Project Planning

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

MITRE has conducted a study to define the management information needs of Air Force Geophysics Laboratory (AFGL) managers and to investigate alternative approaches for the implementation of a management information system (MIS) at AFGL. The study summarizes current management and administrative practices at AFGL. Requirements have been identified for automating several currently manual functions to compile accurate and timely information to better manage and plan AFGL programs.

This document describes the functions and relative priorities of five MIS subsystems and provides suggestions for implementation solutions. Creation of a detailed Development Plan is recommended as the follow-on task.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☒ DTIC USERS ☐	21. ABSTRACT SECURITY CLASSIFICATION Unclassified	
22a. NAME OF RESPONSIBLE INDIVIDUAL Susan R. Gilbert	22b. TELEPHONE NUMBER (Include Area Code) (617) 271-8088	22c. OFFICE SYMBOL M/S D230

DD FORM 1473, 83 APR   EDITION OF 1 JAN 73 IS OBSOLETE.   Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

ACKNOWLEDGMENTS

Accesion For		
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DTIC TAB	☐	
Unannounced	☐	
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Availability Codes		
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SECTION 1

INTRODUCTION

MITRE has conducted a study to define the management information needs of Air Force Geophysics Laboratory (AFGL) managers and to investigate alternative approaches for the implementation of a management information system (MIS) at AFGL. The mission of AFGL is to conduct programs in the terrestrial, atmospheric and earth-related space sciences to support development of Air Force systems. AFGL is currently comprised of seven scientific divisions and three staff divisions.

This document summarizes current management and administrative practices at AFGL. These practices were identified through user interviews and written material furnished by AFGL. Based on the analysis of AFGL management, administrative and scientific needs, requirements have been identified for automating several AFGL MIS functions. Implementable subsystems have been defined, with functions and related solutions delineated for each subsystem.

MITRE has concluded that the management functions which were identified are currently being performed in an inefficient, labor-intensive mode resulting in late and inaccurate reporting. Managers are consuming excessive time in the reporting process. An MIS is needed to compile meaningful and timely information with minimal manual effort to allow AFGL managers more time to spend on productive scientific and technical work. Subsystem implementation priorities are recommended based on user needs (see Section 5). The immediate creation of a development plan, detailing implementation schedules, resources and staffing, off-the-shelf software package installation, and user training is recommended.

1.1 BACKGROUND

The Information Resources Management (RM) Division at AFGL was formed in June 1983. The RM Director embarked on a program to modernize the computer operations and services to be made available from that division, with emphasis on providing AFGL management and scientific and technical staff with automated equipment, tools and capabilities to better perform their work. A study and pilot program to install a local area network were initiated during FY83 and terminals were procured for use throughout AFGL. An operational database was designed and developed to accept, manipulate and store financial data that is monitored by the Technical Operations Branch

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(XOR). RM does not currently run any financial or administrative systems for the divisions (see Section 4.3 for descriptions of current automated systems).

To further modernize AFGL systems, development and implementation of an MIS was considered; in October 1983, the RM Director asked MITRE to conduct a study of MIS requirements.

1.2 STATEMENT OF TASK

MITRE was tasked with analyzing top- and middle-level management information needs to identify MIS functions. Requirements were to be derived from interviews with members of the prototypic scientific division, Space Physics (PH); it was agreed to consider those requirements to be representative of the requirements of the other six scientific divisions.

Upon completion of the requirements analysis, a technical letter presenting an overview of the analysis was delivered. The technical letter described the functions identified, the capabilities and tools required to satisfy the functional requirements, and recommended implementation approaches. A MITRE Technical Report -- contained herein -- has been published as the final task effort.

1.3 OBJECTIVES

The objectives of this task are to:

-    Determine whether AFGL top- and middle-level managers need a formal MIS;

-    Identify functions AFGL management requires in an MIS;

-    Specify tools and capabilities to satisfy the requirements;

-    Recommend approaches for developing and implementing an MIS;

-    Identify any near-term enhancements that may facilitate current operations.

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SECTION 2

SCOPE AND METHODOLOGY

As specified in the TO&P, the MIS analysis focused on the MIS
requirements of AFGL top- and middle-level management. AFGL chose
the PH Division as the prototypic division to be analyzed for MIS
requirements and functions. The three staff divisions were also to
be involved in the interview process to provide input into current
operations and MIS requirements. A questionnaire was to be devel-
oped to identify functions within the other scientific divisions.

Users from several scientific divisions and the three staff
divisions were interviewed to identify AFGL MIS requirements. Ap-
pendix A lists interviewees and topics discussed. The user discus-
sions focused on current procedures, requirements, problems, and
anticipated changes in the planning, tracking and management of the
AFGL scientific work program. MITRE also reviewed AFGL written
documentation (a bibliography appears in Appendix B) and searched
literature for information on currently available hardware and soft-
ware (planning and modeling software packages are described briefly
in Appendix C).

The study was intended to: determine the information required
for AFGL managers to manage current programs and to plan for future
programs, and determine the information that AFGL managers must
supply to their superiors and outside organizations.

MITRE advised on software tools to assist in near-term enhance-
ment of AFGL information processing capabilities. Based on MITRE's
recommendation, RM procured the SuperComp-Twenty spreadsheet pack-
age; MITRE also identified three vugraph packages from DEC -- VAX
DECgraph, VAX DECslide, VAX ReGIS Graphics Library (RGL) -- for RM
review.

2.1 USER INTERVIEWS

Interviews were conducted extensively within the PH Division,
as arranged by the RM Director. Members of the Technical Plans and
Operations (XO) and Research Services (SU) Divisions were also in-
terviewed to gain insight into the current financial and administra-
tive processing of AFGL. To further understand the current AFGL
automated systems, members of the Electronic System; Division (ESD)
Accounting and Finance Office (ACF) were also interviewed. A staff
member of Rome Air Development Center (RADC) -- based at AFGL -- was

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interviewed as well, to discuss a system developed for and used by
RADC and to review RADC needs for management information to be pro-
vided by AFGL.

Interviews were conducted with other AFGL scientific staff by
arrangement with the RM Director. A questionnaire (see Appendix D)
was developed for the purpose of interviewing division directors.
Interviews were held with Bedford Research Associates (BRA), consul-
tants to AFGL involved in the automation of XOR, to determine the
scope of the BRA project to design and develop an operational data-
base and the relationship of that database to the AFGL MIS. Samples
of forms, reports, and relevant data inputs and outputs were re-
quested during all interviews.

2.2 RESEARCH

AFGL furnished written material describing the nature of AFGL's
work, policies and procedures, and program planning. One particu-
larly valuable tool, the "AFGL Administrative Practices Management
Handbook," contains working instructions for planning and initiating
contracts, procedures for providing data to current AFGL systems,
management review requirements, and administrative practices. As
the AFGL MIS requirements began to emerge, MITRE searched computer
trade publications and directories for information about product
availability and technical alternatives.

SECTION 3

RELEVANT FINDINGS

The interviews with members of scientific and staff divisions led to identification of AFGL MIS functions and definition of requirements for an automated MIS based on current and anticipated needs within each function.

The findings covered below include:

- Assumptions, limitations and exclusions;

- Mission and organization;

- Functional requirements within the current environment;

- Future requirements.

3.1 ASSUMPTIONS, LIMITATIONS AND EXCLUSIONS

Several constraints were defined prior to the start of the MIS study. The MIS and associated operational database would operate on the AFGL DEC VAX 11/780 computer. Analysis of other types of computer hardware would not be performed. The software products which have been examined as part of this study are based on the hardware and software constraints established by the RM Director. The impact of computer usage as a result of the implementation of an MIS was not to be analyzed as part of this study. Moreover, data security requirements had been previously established as part of the development of the operational database and would not be addressed as part of this study.

DEC VT-1xx type terminals and IBM Personal Computers (PCs) were identified as the standard MIS terminals. Application and utility software packages such as DEC All-in-One and SuperComp-Twenty are currently installed on the VAX 11/780.

It is assumed that current AFGL financial systems, such as Job Order Cost Accounting System (JOCAS), Management and Scientific Information System (MASIS), Standard Base Level Accounting System (General Accounting), Standard Base Supply System (SBSS) and Equipment Maintenance and Management System (EMAS), will continue to be used, without major modification. It is anticipated, however, that those systems will be modified to provide data access to and from

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the MIS.

The Lexitrons and other word processors currently installed at AFGL will continue to be used and will be included in any proposed word processing recommendations.

3.2 MISSION AND ORGANIZATION

AFGL, with approximately 650 staff members at present, reports to the Air Force Space Technology Center (AFSTC) at Kirtland Air Force Base, New Mexico, which in turn reports to Space Division at Los Angeles Air Force Station. Seven of the ten AFGL divisions perform scientific work; the remaining three divisions perform over-head functions, including financial and administrative services, and technical services. The mission of AFGL is to conduct programs in the terrestrial, atmospheric and earth-related space sciences to support development of Air Force systems and to provide technical solutions to Air Force geophysical problems. The programs include research program elements (PEs) (6.1), exploratory development PEs (6.2), advanced development PEs (6.3) and engineering development PEs (6.4). In FY84, AFGL received approximately 66% of its funding from Air Force Systems Command (AFSC) 6.2 and 6.1 PEs. Additional funding comes from an Air Force Office of Scientific Research (AFOSR)-managed 6.1 research program as well as 6.3 advanced devel-opment programs. Funds are also received from other organizations, such as Defense Mapping Agency (DMA), Defense Nuclear Agency (DNA), and Defense Advanced Research Project Agency (DARPA), for support of programs of mutual interest.

Also housed at the AFGL complex at Hanscom are approximately 60 RADC employees, to whom AFGL provides administrative, financial and technical services.

3.3 CURRENT AUTOMATED SYSTEMS

The Computer Center at AFGL currently does not run any finan-cial or administrative systems for the divisions. JOCAS, developed for the Air Force laboratories in 1968, serves as the AFGL financial system. JOCAS is a batch processing system that is run remotely on the base level computer at Pease AFB after other accounting systems -- General Accounting, SBSS and the local labor reporting system -- have completed their monthly processing under control of ESD/ACF; outputs from those systems can then be processed through JOCAS. Due to the wait for the other accounting systems to complete their work and the delay in processing a large batch system that has a low scheduling priority on the base level mainframe, data reflected on

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the current month's JOCAS reports may be as much as six to eight weeks behind the actual data processed by month-end.

MASIS provides AFSC with centralized automated data concerning management and scientific activities for the laboratories. MASIS input forms are completed by the divisions, reviewed and entered into a file on a dedicated MASIS terminal during the day in XOR; the file is then polled at night. Processing is performed on a computer at Andrews Air Force Base. Every Work Unit (described in Section 4.4.1 below) is assigned a JOCAS number and has a MASIS record. The divisions are required to review these MASIS records semi-annually for accuracy and completeness.

3.4 FUNCTIONAL REQUIREMENTS WITHIN THE CURRENT ENVIRONMENT

Interviews with several divisions led to some interesting discoveries and conclusions. The lack of a formalized MIS has led each division to manage programs in its own fashion. As a result, all divisions are independently performing the same functions, generally using the same procedures. Those functions are:

1. Program financial tracking

2. Management reporting

3. Program coordination

4. Scientific and techncial research

5. Program planning

Brief descriptions of these functions follow.

3.4.1 Program Financial Tracking

Tracking the status of program funds involves many activities on the part of program managers. The most detailed level of program tracking is the Work Unit (WU). Funding is specified by WU, as is the associated tracking of spending against those funds. Preparation and monitoring of Procurement Request (PR) packages, which are funded at the WU level, is an important aspect of program management, due to the significant portion of program funds generally allocated to contractors. Tracking of supplies and equipment, temporary duty status, and labor charges are also important to the successful management of programs.

The division personnel interviewed, including division direc-
tors, branch managers, division administrators (in the scientific,
financial and administrative divisions) and program coordinators
were unanimous in citing timing and accuracy deficiencies in JOCAS,
MASIS and other financial tracking reports, such as the Status of
Program Summary, Status and Analysis Report (STAR) and Open Document
Listing, for managing and tracking the status of their programs.
Each division maintains internally designed manual tracking forms to
provide current status information. Another objection voiced by all
division-level interviewees was the redundant handling of data to
satisfy the input needs of several automated and manual systems.

Each March the scientific division directors prepare the In-
House Work Units (IHWUs) and Contract Work Units (CWUs) for the
program elements for which they are responsible. The combined WUs
represent their proposed work effort for the following fiscal year.
The SU and RM Division Directors prepare comparable Spending Plans.
After approval from the Commander, the funding for the IHWUs and
CWUs constitutes the working budget for the programs. Data for work
units are entered on Lexitron word processors located throughout
AFGL. All Work Unit data for FY85 is being entered into the opera-
tional database developed by Bedford Research Associates.

Each division that was interviewed has developed a tracking
mechanism to manually record the status of spending against budgeted
program dollars and program funding to date. Information is manual-
ly entered on these reports when the source documents (such as PR
packages) leave the division, when notification of approval is re-
ceived from XOR and when notification of funds commitment/obligation
is received from ESD Procurement Office (PK) (see Figure 1 for sam-
ples of tracking plans). According to the division directors,
branch managers and division administrators interviewed, these
tracking mechanisms are maintained due to the lack of current and
accurate reports from the currently available automated systems.

PRs are prepared by members of each division -- approximately
20 PRs per month in the PH Division -- and are sent to XOR for re-
view. XOR processes approximately 600 PR packages per fiscal year;
each PR package may be subjected to several actions, such as modifi-
cations, funding actions, etc., during the fiscal year. A simple PR
package may contain at least 15 pages; the appropriate number of
copies -- typically 10 or more per PR package -- are made by the
preparer. After manually recording its progress through AFGL, XOR
sends the PR to PK for procurement. Notification of funds commit-
ment and obligations are sent to XOR, where the status of funds is
manually tracked. XOR in turn sends notification of the PR status
to the responsible division, where it is also manually tracked.
Reports of PR status are produced by JOCAS at month-end.

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SPACE PHYSICS DIVISION
FY 84 SPENDING PLAN 2311G2

Page 1 of 2
Date: 19 DEC 1983

CONTRACTOR	MANAGER	JON	PR NO. $ 2311G2	$ P7601	$ S.D. P.D.83-208	$ DNA	CONTRACT NO.	PI

SPACE PHYSICS DIVISION
FY 84 SPENDING PLAN 2311G2

Page 2 of 2
Date: 19 DEC 1983

CONTRACTOR	MANAGER	JON	PR NO. $ 2311G2	$ P7601	$ S.D. P.D.83-208	$ DNA	CONTRACT NO.	PI

FY 84 G106GL + 612310 CHD

AS OF 31 DEC 83

EEIC	ALLOCATED 35%COM	COM 23%CBL	DBL	EXP 8%EXP	DUE-OUT	UNCOM BALANCE

AFGL MST BUDGET/FUNDING/INITIATIONS/OBLIGATIONS

6 JAN 84

EFFORT	FY84 BUDGET	FY84 FUNDING TO DATE	FUNDING DOCUMENT	INITIATIONS AMOUNT	DOCUMENT	OBLIGATIONS AMOUNT	DATE

AFGL MST EARNINGS/EXPENDITURES

6 Jan 84

EFFORT	FY84 EARNED (CUMULATIVE) AMOUNT	AS OF	FY 84 EXPENDED (CUMULATIVE) AMOUNT	AS OF	FY 84 PROJECTED EARNED (CUMULATIVE) 31 JAN 84	30 APR 84	31 JUL 84	30 SEP 84

Figure 1. Samples of Financial Tracking Reports
Designed by AFGL Divisions

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The divisions use manual methods in ordering supplies and equipment (S&E). Form DD 1348-6 is sent to the Materials Services Branch (SUM) where it is processed through various automated systems. SUM recently installed a bar-code scanning inventory control system and plans to expand the functionality of that system to include automated S&E tracking and, after coordination with the RM Director, an MIS. Currently, the division administrators interviewed maintain manual logs for tracking S&E (refer to Figure 2). The reports are received from the JOCAS system and do not provide data in a timely manner.

Similarly, the division administrators manually track temporary duty (TDY) status (see Figure 2). Travel dollar status information is requested on an ad hoc basis from the Branch Managers. A TDY Expense Statement is generated from the current automated system; however, the report does not provide data for the current month.

Each month, hours worked are recorded in two ways. Biweekly time cards are completed and signed on the Time and Attendance Card. Each month a Job Order Estimating Form is also completed; the data is keypunched for entry into the JOCAS system to distribute salary costs among In-House Work Units. The individuals interviewed would like to see the manual transcription of the JOCAS worksheet -- a time-consuming process -- eliminated.

3.4.2 Management Reporting

Division directors must provide the Commander with periodic information regarding the status of programs. Those responsible individuals voiced strong desires to reduce the effort needed to provide this information.

Technology Management Reviews (TMRs) are scheduled semi-annually. Each manager must complete a TMR Work Unit Assessment Form for each Work Unit under his or her jurisdiction. Additionally, a structured oral briefing, requiring standardized vugraphs, is presented for each program.

Management Assessment Reviews (MARs) are conducted monthly for all AFGL-managed 6.3 and 6.4 programs. The program manager briefs the Commander using a vugraph presentation that follows a standard structure.

SUPPLIES & EQUIPMENT LOG

ALLOCATION $ _____   FUND SOURCE: _____   JOCAS: _____

DATE	SEQ. NO.	REQUESTOR	ITEM	QUANTITY	UNIT COST	TOTAL COST	BALANCE

TEMPORARY DUTY (TDY) EXPENSE LOG

FUND SOURCE: _____   FY _____

NAME OF TRAVELER(S) A	JOCAS B	DATES OF TRAVEL C	DESTINATION D	TRAVEL E	ACTUAL TRNSP COST F	ACTUAL PERDIEM AND OTHER COSTS G	TOTAL ACTUAL COSTS H	BALANCE I

Figure 2. Samples of Manual Tracking Logs

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Other reviews are required in addition to the TMRs and MARs. AFGL scientific division managers also prepare vugraph presentations for the annual Air Force Systems Command Director of Science and Technology (AFSC/DL) review, AFOSR review, Pentagon review and DMA review.

PH Division managers indicated that a typical manager produces 1000 vugraphs annually, covering presentations for the TMRs and MARs, briefings to customers and reports to AFGL management. Vugraph copy, typed on paper on a typewriter or word processor, is sent to the Photo Lab, where transparencies are prepared. Any modification to a vugraph presentation requires a repeat of the entire manual process. The branch managers indicated that modifications are generally required after a dry run is performed of any briefing.

3.4.3 Program Coordination

Manual tracking logs are maintained at both the division and branch levels. Unsolicited proposals are logged and tracked in the Technical Plans Branch (XOP). Approximately 120 unsolicited proposals are processed annually. Each division is required to evaluate the proposal within 30 days and return appropriate comments to XOP. Branch managers and the XOP Unsolicited Proposal Administrator indicated that tracking the status and whereabouts of unsolicited proposals is a difficult process in the current manual environment. Division management indicated that the current manual tracking process is inefficient and that the logs are not completely accurate.

The divisions are responsible for monitoring contractors' compliance on a quarterly basis. A letter must be sent to PK to approve release of funds to a contractor. Scientific division management indicated that, at present, the quarterly tracking of compliance is accomplished after the fact and that compliance is not being monitored properly as a management tool. Tracking of contractor compliance as information is received and reporting of compliance at the end of each quarter would eliminate the time-consuming activity now required to gather this information.

Management is periodically required to provide information relating to in-house and contractor technical reports. Currently, as described by scientific division management, this information must be accumulated upon receipt of each request, necessitating time-consuming collection and sorting of data. A system to track technical report information would save time and maintain accurate data for reporting of status information by Work Unit or by originating organization.

Management is required by Air Force regulations to perform inventories for ADPE and accountable property. Semi-annually a list is distributed from SUM requesting notification of any inventory changes in accountable property. The RM Division distributes lists of ADPE inventories and requests notification of changes. Scientific division management stated that a capability is needed to keep the division inventory on a tracking file with inventory changes recorded as they occur; this would provide more accurate data and would substantially reduce the effort -- several days at present -- required to physically perform the inventories. The production of a hardcopy printout of each division's inventory file would assist in verification of physical inventory when required by Air Force regulations.

Communication between program managers and staff is informal and generally verbal. All managers interviewed agreed that the current communication methods are satisfactory.

3.4.4 Scientific and Technical Research

Managers, scientists and technical staff at AFGL require access to research information to perform their technical work. A number of branch managers indicated that capability to search public-access catalogs would be valuable; search time would be shorter and the scientists would be able to locate specific information of interest to them. The current procedure for performing a library search is to request a subject search from the AFGL Research Library Reference Staff, who perform on-line searches through various databases available at the Library.

A manual process is used at present to produce in-house technical reports. A paper draft copy -- or a floppy disk, if the draft has been keyed into a Lexitron word processor -- is delivered to the In-house Technical Report Editor, who prints out a hard copy if supplied on a floppy disk, edits the hard copy and returns it to the author for approval. The hard copy manuscript is sent to a contractor for typing on an IBM Executive typewriter; the output is used as camera-ready copy. After review by the editor, the copy is sent to Base printing where the document is printed and bound. According to the In-house Technical Report Editor (who edits all in-house technical reports for AFGL and collocated RADC staff members), this process, which yields approximately 140 reports annually, is in need of upgrading and streamlining. In particular, IBM no longer manufactures Executive typewriters; plans for an alternative method of producing camera-ready copy must be developed. Automation alternatives must take into account AFGL's needs to print complex mathematical equations.

The In-house Technical Report Editor also cited the need to reduce the time consumed in editing and layout, without compromising the quality of the finished product.

3.4.5 Program Planning

AFGL program planning uses five-year projections of technical program element funds. These five-year projections are included in many types of AFGL management reports. Types of program plans include:

Program Objectives Memorandum (POM). Prepared annually by each division director's office for 6.2 funds. The POM is used as the AFGL input to establish next year's funding to eventually become part of the President's budget. All funding amounts are extended over a five-year period.

AFGL Technical Program Review. Compiled annually for AFSC/DL, including 6.1, 6.3 and other customer money. Funding is specified for five years beginning with the current fiscal year.

AFGL Research and Technology Plan. Prepared annually by each Division Director's office. Funds and staff-years by program element and project are specified for a five-year period beginning with the current fiscal year.

Program plans are currently prepared manually. All projections are currently calculated manually. The scientific division personnel have indicated that the current manual procedures for program plannning are suitable for their needs. However, conversations with the RM Director on the subject of program planning have addressed the possibility that more structured attention may be required during the coming fiscal year by AFGL, AFSTC and Space Division management for development and planning of AFGL programs. The new AFSTC Commander, in fact, developed the AFGL Technical Program Review process and documentation standards when he served as Commander of AFGL. It is anticipated that at least minimal automated support will be required to assist division directors in the planning of programs.

3.5 FUTURE REQUIREMENTS

Discussions with division management uncovered future requirements that relate to functional areas identified in Section 3.4 above.

According to some of the division directors and branch managers, the emphasis of program funding has shifted in recent years from research (6.1) towards exploratory development (6.2) with increased funding for advanced development programs (6.3); it appears that this trend will continue. This is significant because the 6.3 programs are generally more sizable and require greater administration and management. Accounting for funding types vary: 6.1 program salaries and overhead are reimbursed by AFOSR, whereas 6.2 are not reimbursed and 6.3 program costs vary. Program coordinators for 6.3 funds voiced the strongest opinions that current financial reports are not satisfactory for monitoring these large, complex programs.

It is anticipated that MASIS will be merged in the future into the Command Management Information System (CMIS). Data required for MASIS should be maintained on the operational database to be available for transmission to CMIS when the CMIS data requirements have been identified.

The EMAS System recently installed in SUM is expected to be expanded to encompass budget management, requisition tracking, receipt, shipping, and funds management information. This data must be integrated with the operational database for use of division managers. The design of an MIS will be coordinated with the RM Director in accordance with overall AFGL MIS policy.

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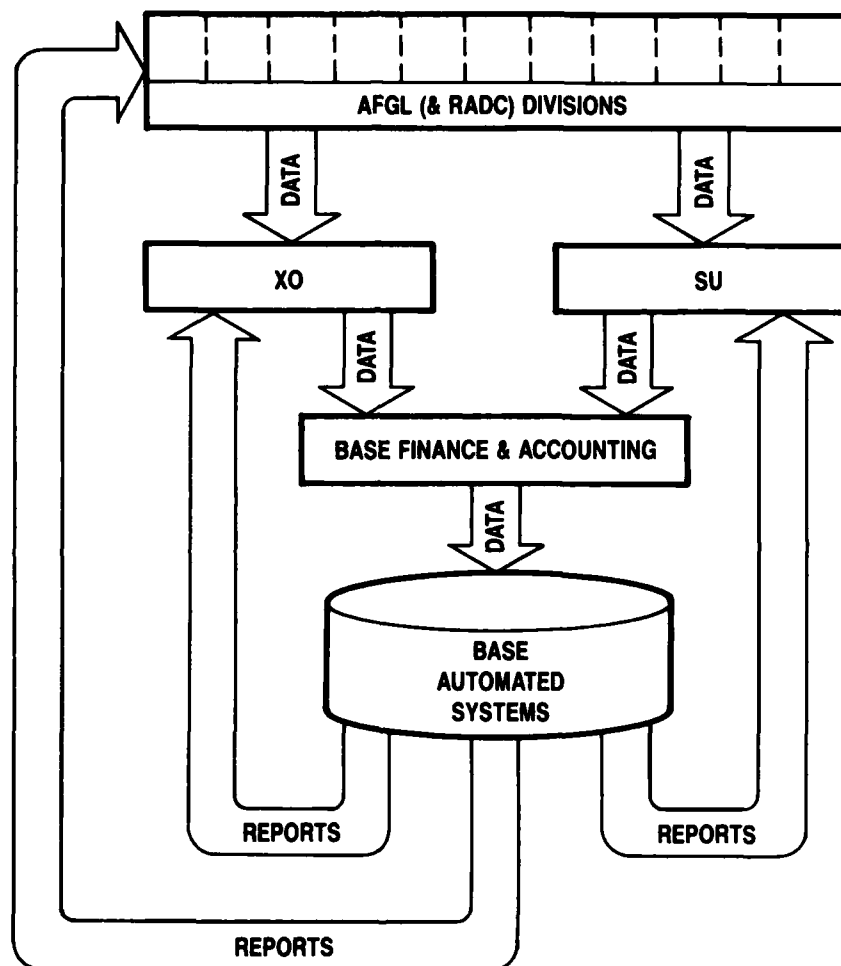# SECTION 4

POSSIBLE SOLUTIONS

Based on the analysis of needs of AFGL managers, administrators and scientists, requirements have been identified for automating several AFGL MIS functions. These requirements, partitioned into subsystems, can be satisfied through implementation of software tools and capabilities that can be developed internally or purchased as off-the-shelf packages. Possible implementable subsystems are listed below:

1. Financial Reporting Subsystem

2. Management Reporting Subsystem

3. Program Control and Communication Subsystem

4. Scientific and Technical Support Subsystem

5. Program Planning and Forecasting Subsystem
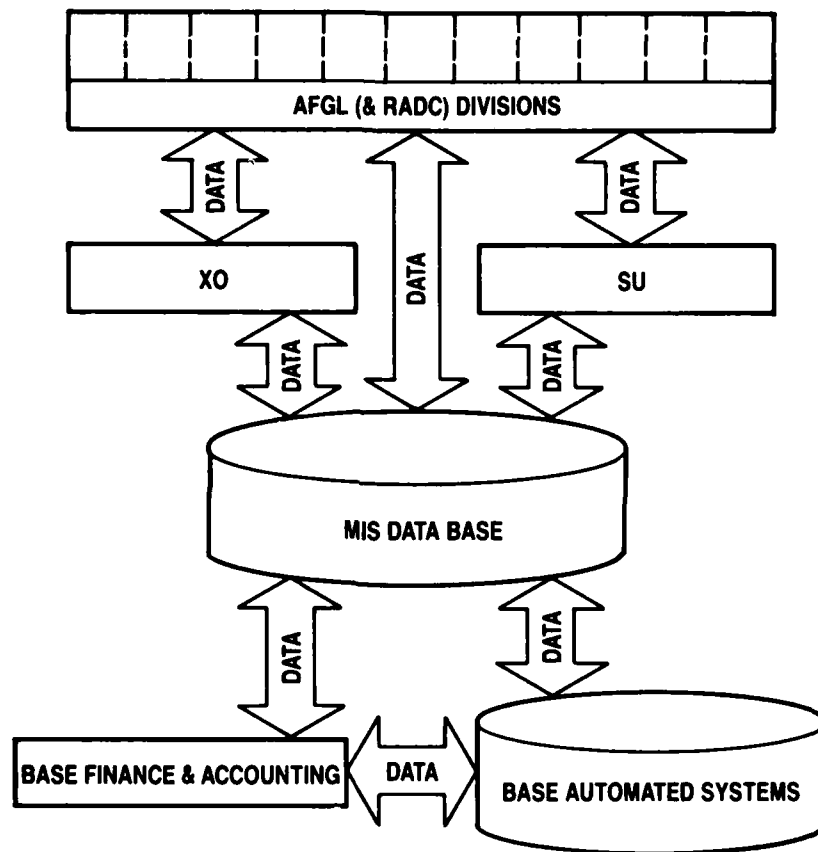
4.1 FINANCIAL REPORTING SUBSYSTEM

Functions: Provide the Commander, division directors, branch managers, program managers, administrators and scientists with accurate, timely reports of program initiations, commitments, obligations and expenditures; provide source data entry for Work Unit data, PR data, MASIS data.

Solutions: Expand the current operational database to maintain data required to supply necessary reports; design and develop tailored management reports through use of an off-the-shelf report generator for scientific, administrative and financial managers and administrators; design and develop terminal sessions using those tools that were used for the XOR terminal session development for source data entry of financial data; interface operational database to ESD base level systems, on-line or via tape transfers; design and develop a single automated method for dealing with salary and time sheet data (refer to Figures 3 and 4 for current and proposed data access paths).

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IA–70,292

Figure 3. Current Data Access Path

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Figure 4. Proposed Data Access Path

IA-70,307

4.2 MANAGEMENT REPORTING SUBSYSTEM

Functions: Provide capabilities for automated development, storage and production of vugraphs; provide automated creation of AFGL TMR Work Unit Assessment sheets.

Solutions: Investigate off-the-shelf packages for installation of automated vugraph software on the VAX 11/780 or arrange for use of vugraph systems already available, such as the ESD vugraph system; develop tailored vugraph system session for creation of a standard AFGL briefing; develop automated generation of TMR Work Unit Assessment forms from updated financial work unit data residing on the operational database.

4.3 PROGRAM CONTROL AND COMMUNICATION SUBSYSTEM

Functions: Provide managers and administrators with capabilities to communicate, monitor and organize program activities; provide on-line capability to track in-house and contractor publications, unsolicited proposals, contractor compliance, personnel, and security logs; provide on-line suspense capability.

Solutions: Provide standardized suspense, calendar, and pending files through use of DEC All-In-One office automation software package; develop standardized file layouts using existing DEC All-In-One office automation software package for tracking and reporting information on publications, unsolicited proposals, contractor compliance, personnel, and security.

4.4 SCIENTIFIC AND TECHNICAL SUPPORT SUBSYSTEM

Functions: Support production of in-house technical reports; provide on-line library research capability for scientists and technical staff.

Solutions: Implement standardized word processing throughout AFGL; procure and install printer to produce camera-ready quality hard copy for printing in-house technical reports; develop interface to AFGL Research Library on-line search capabilities.

4.5 PROGRAM PLANNING AND FORECASTING SUBSYSTEM

Functions: Support development of AFGL near- and long-term pro-
grams; provide automated budget and expenditure fore-
casting capabilities.

Solutions: Perform functional requirements analysis; provide pro-
ject planning with an off-the-shelf package (a super-
ficial investigation of project planning and management
packages for the VAX 11/780 uncovered 29 alternatives;
see Appendix C); develop standardized projection methods
on the SuperComp-Twenty spreadsheet installed on the VAX
11/780 for five-year budget and expenditure projections.

SECTION 5

CONCLUSIONS AND RECOMMENDATIONS

The interviewees identified the MIS functions presently execut-
ed at AFGL and clearly indicated that these functions are universal-
ly performed in an inefficient, labor-intensive mode; as a result,
reports are incomplete, late or inaccurate and excessive management
time is consumed in the reporting process. An MIS is needed that
will compile timely, accurate information with minimal manual effort
and allow AFGL managers more time to spend on productive scientific
and technical work.

The interviews revealed that it is critically important to up-
grade certain subsystems as soon as possible, giving rise to the
following recommended priority list for subsystem implementation.

1. Financial Reporting Subsystem

2. Management Reporting Subsystem

3. Program Control and Communication Subsystem

4. Scientific and Technical Support Subsystem

5. Program Planning and Forecasting Subsystem

Several of the subsystems may be developed in parallel. For
example, certain financial reporting functions may be developed con-
currently with procurement of a vugraph system and with analysis of
the Program Planning and Forecasting Subsystem requirements.

Production of in-house technical reports should be carefully
considered because of a potentially high dollar payoff. We believe
that the Scientific and Technical Support Subsystem should be con-
sidered for early implementation -- although it is fourth on the
priority list -- because of the significant potential savings in
operating costs that may be realized in automating the production of
in-house technical reports.

The initial implementation step should be creation of a detail-
ed Development Plan defining the scope of each subsystem and an im-
plementation schedule, together with resources needed and staffing
levels for development, package installation, user training and cost
estimates for off-the-shelf package procurements.

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An effective MIS can be built upon the established hardware architecture, making use of the electronic mail, spreadsheet and other tools that have already been procured. Further analysis will be necessary to determine whether the existing data base management system will be adequate to manage the additional data flow and traffic generated by the MIS.

APPENDIX A

AFGL MIS STUDY MEETINGS

Date	Attendees	Subject
8 Dec 83	E. Cronin (RM)	Initial MIS Study discussion
13 Dec 83	A. Rebello (RM)	Discussion of In-house and Contractual Work Units
22 Dec 83	R. Sagalyn (PH)	PH Division Director MIS requirements discussion
22 Dec 83	C. Pike (PHK)	PHK Branch Manager management functions and procedures
27 Dec 83	M. Outwater (PH)	PH Division Administrator functions and procedures
27 Dec 83	E. Mullen (PHP)	PHP Branch Manager management functions and procedures
28 Dec 83	R. Babcock (PH)	PH Deputy Division Director management functions and procedures
5 Jan 84	W. Hall (PHK)	Discussion of program budget management for PH Division
9 Jan 84	A. Barnes (LYC)	LYC Branch Manager management functions and procedures
17 Jan 84	Bedford Research Associates	Discussion of plan for development of AFGL operational database
18 Jan 84	Bedford Research Associates	Demonstration of operational database
18 Jan 84	Ungermann Bass	LAN Seminar
25 Jan 84	J. Cottrell (LYS)	Discussion of LYS Branch 6.3 Program Coordination procedures
30 Jan 84	K. Cottrell (LSP)	Discussion of LSP Branch 6.3 Program Coordination procedures

APPENDIX A (CONTINUED)

AFGL MIS STUDY MEETINGS

Date	Attendees	Subject
1 Feb 84	E. Cronin (PH)	Status discussion
3 Feb 84	A. Sizoo (SUL)	SUL Branch Manager management functions and procedures
3 Feb 84	W. Harding (XOR)	Discussion of JOCAS processing in XOR
3 Feb 84	R. Ross (ACF)	Discussion of JOCAS processing at ACF
3 Feb 84	N. Amico (ACF)	Discussion of funds approval process
7 Feb 84	I. Michael (PHG)	PR package preparation for PH Division discussion
7 Feb 84	H. Singer (PHG)	Discussion of MIS alternatives with PH scientist
9 Feb 84	R. Lynch (SUM) J. Norton (SUMS)	SUM branch and management functions and procedures
13 Feb 84	A. Almon (XOR)	Discussion of MASIS and cost accounting methods
22 Feb 84	L. Ariema (RADC)	Interview with RADC staff member who uses Laboratory Office Network Experiment (LONEX) System
29 Feb 84	Maj. T. Cardona (AFSC)	Discussion of EMAS property accountability system with EMAS system designer
5 Mar 84	R. Seidman (SULL)	Interview Library Director on library procedures, systems and on-line search capabilities
7 Mar 84	F. Stewart (XOR)	Interview (XOR) financial staff to review PR processing
15 Mar 84	E. Cronin (RM)	Status discussion
19 Mar 84	E. Cronin (RM)	Status discussion

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APPENDIX A (CONCLUDED)

AFGL MIS STUDY MEETINGS

Date	Attendees	Subject
20 Mar 84	J. Dempsey (SULR)	Interview technical editor on production of in-house technical reports
23 Mar 84	D. Eckhardt (LW) J. Viera (LW) T. Rooney (LWG)	Interview LW Division management and administrator on MIS functions
26 Mar 84	E. Cronin (RM)	Status discussion
27 Mar 84	W. Gotha (MITRE)	Review of MITRE's technical report production and discussion of AFGL's alternatives
27 Mar 84	E. Cronin (RM)	Status discussion
27 Mar 84	N. Dimond (XOP)	Interview XOP administrator on unsolicited proposal and Independent Research and Development tracking
9 May 84	E. Cronin (RM)	Review of technical letter draft
10 May 84	E. Cronin (RM)	Review of BRA Specifications for Automation of XOR
10 May 84	A. Almon (XOR)	Discussion of Time Sheet submissions
11 May 84	E. Cronin (RM)	Demonstration at MITRE of Program Planning and Management, Vugraph and Intellect systems

APPENDIX B

AFGL DOCUMENTS FURNISHED TO MITRE FOR REVIEW

The Air Force Geophysics Laboratory, Report on Research at AFGL - January 1979 - December 1980, AFGL-TR-82-0132, April 1982.

Air Force Geophysics Laboratory, AFGL FY 84-88 Research and Technology Plan, AFGL-TR-82-0292, Special Report No. 231, September 1982.

Air Force Geophysics Laboratory, Roster of Projects and Tasks, October 1982.

Air Force Geophysics Laboratory, "AFGL Administrative Practices Management Handbook," AFGLP 11-4, March 1982.

Air Force Space Technology Center, Air Force Geophysics Laboratory, AFSC/DL Technical Program Review, June 1983.

APPENDIX C

PLANNING AND MODELING SOFTWARE PACKAGES
FOR THE VAX 11/780 AND IBM PC

ICP SOFTWARE DIRECTORY, Volume 3, Management & Administrative
Systems, 1984

Packages listed in this section operate on the DEC VAX under VMS.

Criteria: Over 15 users (or number of users not listed); price
           listed under $25,000 (or price not listed).

ABC/FINANCIAL PLANNING, MODELLING AND REPORTING SYSTEM
    ABC Management Systems, Inc., Bellingham, WA 98225
    100 users - price upon request.
ASAPMS PROJECT MANAGEMENT SYSTEM
    Andrew Sipos Associates (ASA), New York, NY 10280
    175 users - $9,000 and up.
CONTROL STRATEGIST
    Xerox Computer Services, Los Angeles, CA 90066
    Users not specified - price upon request.
CRITICAL PATH METHOD (CPM)
    Technical Economics, Inc., Albany, CA 94707
    65 users - price upon request.
DATA*MODEL FINANCIAL MODELING SYSTEM
    Minicomputer Modeling, Inc., Seattle, WA 98109
    400 users - $995 to $6,500.
DOLARS FINANCIAL PLANNING SYSTEM
    Landmark Software Systems, Inc., Somerville, NJ 08876
    Users not specified - price upon request.
FINANCIAL PLANNER FOR VAX AND RSTS/E
    Interactive Management Systems, Inc., Belmont, MA 02178
    50+ users - price upon request.
FINAR - FINANCIAL ANALYSIS AND REPORTING SYSTEM
    James B. Holtze and Company, Houston, TX 77056
    150 users - $9,800.
FINESSE - FINANCIAL MODELLING SYSTEM
    The P-E Consulting Group, Egham, Surrey, UK TW20 OHW
    20/30 users - £5800.
FORESIGHT
    Information Systems of America, Inc., Atlanta, GA 30362
    298 users - price upon request.
FPS-80, FINANCIAL PLANNING AND REPORTING SYSTEM
    RTZ Computer Sciences Ltd., London UK SW1Y 4LD
    20 users - £5,000 to £15,000.

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APPENDIX C (CONTINUED)

PLANNING AND MODELING SOFTWARE PACKAGES
FOR THE VAX 11/780 AND IBM PC

ICP SOFTWARE DIRECTORY, Volume 3, Management & Administrative
Systems, 1984 (continued)

MAPS/MODEL
   Ross Systems, Inc., Palo Alto, CA 94303
   70 users - $22,500 to $30,000.
MODEL PLANNING AND ANALYSIS SOFTWARE
   Lloyd Bush & Associates, New York, NY 10038
   100+ users - price upon request
NYPLAN FINANCIAL MODELING SYSTEMS
   NYPLAN, Inc., Kirkland, WA 98033
   165 users - $1,500 to $2,500.
PAC I PROJECT MANAGEMENT SYSTEM
   AGS Management Systems, Inc., Philadelphia, PA 19106
   40 users - price upon request.
VUE
   National Information Systems, Inc., Cupertino, CA 95014
   75 users - $16,000 to $23,500.

DATAPRO Directory of Software, Volume 2, March 1984

Packages listed in this section operate on the DEC VAX under VMS.

BAI*PERT
   Micro-Base Corp., Dayton, OH 45459
   15 users - $3,950 to $6,600.
DECISION SHEET/MODELING
   Canadian European Systems, Ltd., Vancouver, British Columbia V6B3X4
   137 users - $5,000 to $17,000.
MISTER
   Shirley Software Systems, South Pasadena, CA 91030
   25 users - $7,000 and up.
PCS 11
   Digital Equipment Corp., Maynard, MA 01754
   100 users - $930 to $2,900.

APPENDIX C (CONCLUDED)

PLANNING AND MODELING SOFTWARE PACKAGES
FOR THE VAX 11/780 AND IBM PC

ICP SOFTWARE DIRECTORY, Volume 7, Microcomputer Systems, 1984

Criteria: Over 15 users (or number of users not listed); price
listed under $10,000 (or no price listed).

All packages listed below operate on the IBM PC. The required op-
erating system is identified within the parentheses.

BUSINESS PLANNER
    Duosoft Corporation, Savoy, CA 61874 (MS-DOS)
    700+ users - $295 to $395.
FCS-EPS
    EPS Incorporated, Windham, NH 03087 (IBM DOS)
    850 users - $2,000.
FORESIGHT
    Information Systems of America, Inc., Atlanta, GA 30362 (IBM DOS,
    PC DOS)
    298 users - price upon request.
INTEPERT
    Schuchardt Software Systems, Inc., San Rafael, CA 94903 (PC DOS)
    Users not specified - price upon request.
LPMASTER
    Applied Operations Research, Inc., Canoga Park, CA 91304 (CP/M,
    MS-DOS)
    Users not specified - $495.
MICRO DECISION SUPPORT SYSTEM/FINANCE (MICRO DSS/F)
    Ferox Microsystems, Inc., Arlington, VA 22209 (UCSD-p System)
    3,000 users - $1,500.
MICROFCS
    Evaluation and Planning Systems, Inc., Windham, NH 03087 (MS-DOS)
    150 users - $2,000.
MILESTONE
    Digital Marketing Corp., Walnut Creek, CA 94595 (CP/M, UCSD-p
    System)
    Users not specified - $295.
PLANTRAC
    Computerline Limited, Quincy, MA 02169 (PC DOS, MS-DOS)
    50 users - $500.

APPENDIX D

QUESTIONNAIRE FOR AFGL DIVISION DIRECTORS

This questionnaire was prepared as a vehicle to direct interview sessions with AFGL Division directors to determine management functions performed at the director level. The management functions performed by the Space Physics (PH) Division have already been investigated. The objective of interviewing the remaining Division directors is to discover any functional differences between those functions identified by the PH Division director and those identified by the other divisions. The anticipated allotted time for each interview is between one and one-and-a-half hours.

1. Describe the organization of your Division and explain what your Division does. (Supply an organization chart, if available.)

2. What functions are performed by each branch in your Division?

3. Please give me a brief overview of the method of administration in your Division. How are projects controlled within your Division? Are any of your projects split amongst other Divisions? How many 6.1, 6.2 and 6.3 projects do you have in your Division?

4. What management information do you get from your branch managers on a scheduled or ad hoc basis? What medium is used to supply this information supplied to you (reports, conversations, etc.)?

5. Do you currently receive any management reports on a scheduled or ad hoc basis to help you track or monitor the status of your Division? If so, what are they?

6. Do you provide your management with specific reports or briefings (such as TMR and MAR)? If so, what are they, what effort is involved to prepare, assemble and revise this information, what volume is produced and what is the schedule?

7. Do you provide personnel outside of AFGL management with specific reports on a scheduled or ad hoc basis? If so, what are they?

QUESTIONNAIRE FOR AFGL DIVISION DIRECTORS

8. Does your Division have an administrator? If so, what is that individual's role? Please explain the role of any administrator at the branch or project/program level (including technical staff assigned to administrative functions).

9. Has your Division developed any tailored reports or forms that are used for tracking purposes (such as to track PR, TDY, S&E, reimbursables)? If yes, please explain and provide samples.

10. What information does your Division use from automated systems, such as from the JOCAS, STAR, General Accounting or MASIS systems? Please provide samples of any reports which are commonly used.

11. Do you have any comments regarding the automated systems that are available to provide you with management information?

12. How do you calculate the five-year projections for your Division for program planning and for inclusion in the POM and Technical Program Review?

13. Do you have any ideas on what type of management information you would like to receive and in what form? What would your priority list be for mechanizing management data? What additional tools or aids would you like to see implemented to assist you in managing your Division?

GLOSSARY

ACF	Electronic Systems Division Accounting and Finance Office
ADPE	Automated Data Processing Equipment
AFGL	Air Force Geophysics Laboratory
AFOSR	Air Force Office of Scientific Research
AFSC	Air Force Systems Command
AFSC/DL	Air Force Systems Command Director of Science and Technology
AFSTC	Air Force Space Technology Center
BRA	Bedford Research Associates
CMIS	Command Management Information System
CWU	Contract Work Unit
DARPA	Defense Advanced Research Project Agency
DEC	Digital Equipment Corporation
DMA	Defense Mapping Agency
DNA	Defense Nuclear Agency
EMAS	Equipment Maintenance and Management System
ESD	Electronic Systems Division (Air Force Systems Command)
ESD/ACF	Electronic Systems Division Accounting and Finance Office
ESD/PK	Electronic Systems Division Procurement Office
IBM	International Business Machines Corporation
IHWU	In-house Work Unit
JOCAS	Job Order Cost Accounting System
LAN	Local Area Network
LONEX	Laboratory Office Network Experiment System
LSP	AFGL Atmospheric Backgrounds Branch
LYC	AFGL Cloud Physics Branch
LYS	AFGL Satellite Meteorology Branch
LW	AFGL Terrestrial Sciences Division
LWG	AFGL Geodesy and Gravity Branch
MAR	Management Assessment Review
MASIS	Management and Scientific Information System
MIS	Management Information System
PC	Personal Computer
PE	Program Element
PH	AFGL Space Physics Division
PHG	AFGL Space Plasmas and Fields Branch

GLOSSARY (CONCLUDED)

PHK	AFGL Spacecraft Environment Branch
PHP	AFGL Space Particle Environment Branch
PK	Electronic Systems Division Procurement Office
POM	Program Objectives Memorandum
PR	Procurement Request
RADC	Rome Air Development Center
RM	AFGL Information Resources Management Division
S&E	Supplies and Equipment
SBSS	Standard Base Supply System
STAR	Status and Analysis Report
SU	AFGL Research Services Division
SUL	AFGL Scientific Information Branch
SULL	AFGL Research Library
SULR	AFGL Research Publications Section
SUM	AFGL Materials Services Branch
SUMS	AFGL Laboratory Materiel Control Activity
TO&P	ESD/MITRE Technical Objectives and Plans
TDY	Temporary Duty
TMR	Technology Management Review
WU	Work Unit
XO	AFGL Technical Plans and Operations Division
XOR	AFGL Technical Operations Branch
XOP	Technical Plans Branch

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